CoAP usages for Device Management

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Managing Networks of Things workshop
draft-jimenez-t2trg-coap-functionality-lwm2m

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ERICSSON

Constrained Application Protocol (CoAP)

- It is a RESTful protocol for constrained devices and networks, very similar to HTTP.

  - Client/server & Request/Response

  - GET, POST, PUT, PATCH, iPATCH, FETCH and DELETE Methods.

  - Same key concepts (Media types, URL, URN…)

- The well-known URI

  - `GET coap://[ip6address]/.well-known/core`

- IPv6 oriented (using 6LowPAN)

  - IP Multicast support

Constrained Application Protocol (CoAP)

- Resource discovery via the Resource Directory (RD)

- Compact 4-byte Header

- UDP, TCP currently being standardised, SMS also possible.

- Reliability is ensured by using with different message types:

  - Confirmable (CON), non-confirmable (NON), acknowledgement (ACK) and reset (RST).

- Observe/Notify, adding an "observe" flag in the CoAP GET Request

  - Introduces a Publish/Subscribe model for constrained devices.

- Facilitates new ways of interacting with devices and managing them

  - CoMI/CoOL

  - LWM2M

Constrained Management and Objects Language (CoOL/CoMI)

- Describes a management function set adapted for constrained devices and constrained networks using YANG.

- Interactions with objects use CoAP a application protocol.

- Payloads are encoded in CBOR data format.

Roadmap

Current targets

Encoding
I-D.ietf-core-yang-cbor

Identifiers
I-D.somaraju-core-sid

Protocol operations
I-D.veillette-core-cool

Discovery
I-D.veillette-core-cool-library

Future work

Security
- Boot strapping
- Authorization
(Profile of existing methods)

Protocol extensions
- Multicast
- Binding table
- Application management
- OTA upgrade

Support for LWM2M

# Constrained Management and Objects Language (CoOL/CoMI)

- Similar to RESTCONF but:

  - uses CoAP/UDP as transport protocol. RESTCONF uses HTTP/TCP.

  - uses CBOR as payload format. RESTCONF uses JSON or XML.

  - CoMI encodes YANG identifier strings as numbers, where RESTCONF does not.

  - CoMI uses the methods FETCH and iPATCH, not used by RESTCONF.

  - RESTCONF uses the HTTP methods HEAD, and OPTIONS, which are not used by CoMI.

  - … and many more at https://tools.ietf.org/html/draft-vanderstok-core-comi-10#page-7

OMA Lightweight M2M (LWM2M)

Essentially CoAP with …

- Management Interfaces.

  - Bootstrap: bootstrapping and upgrading a device

  - Registration: taking a device into a logical group

  - Management: by writing / creating objects inside the device

  - Information Reporting: reading objects inside a device

- LWM2M Object Model

  - Objects can correspond to sensors or actuators
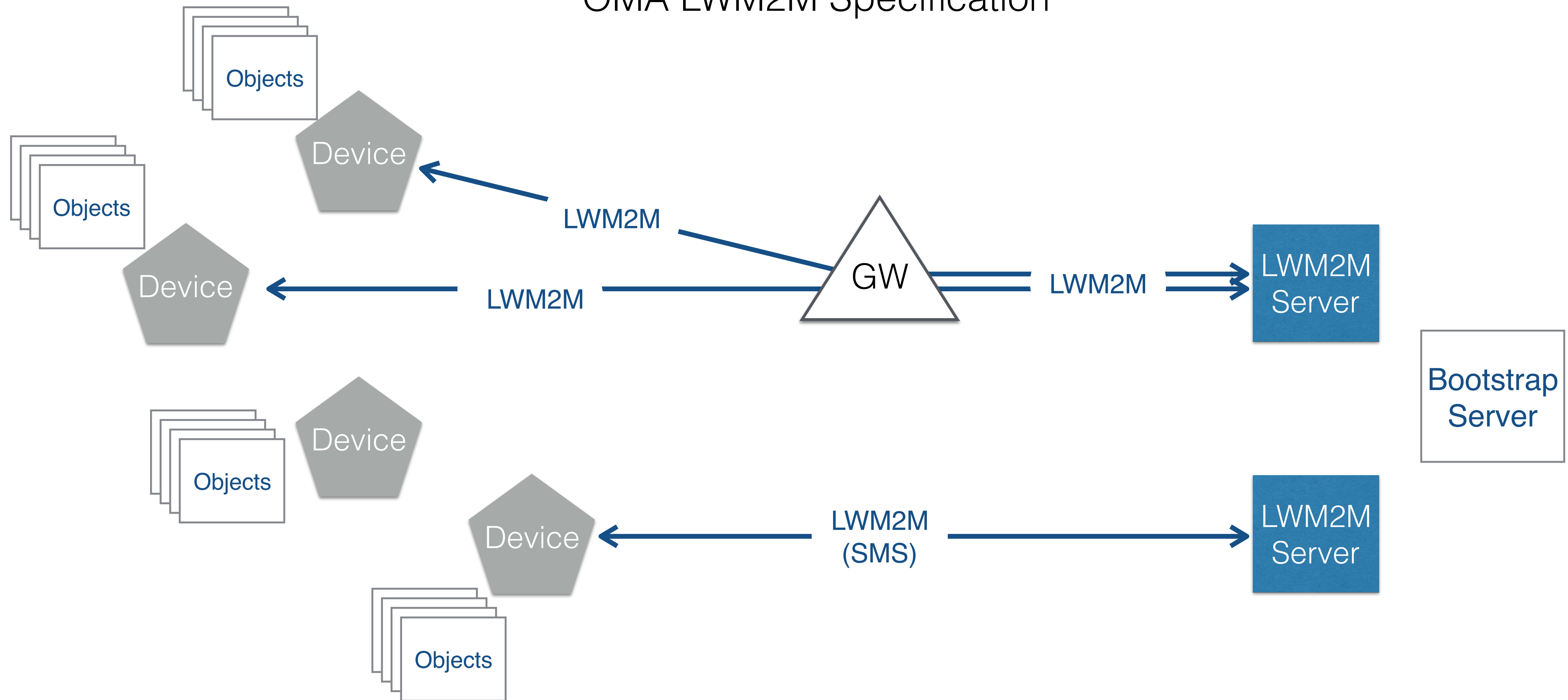
OMA Lightweight M2M (LWM2M)
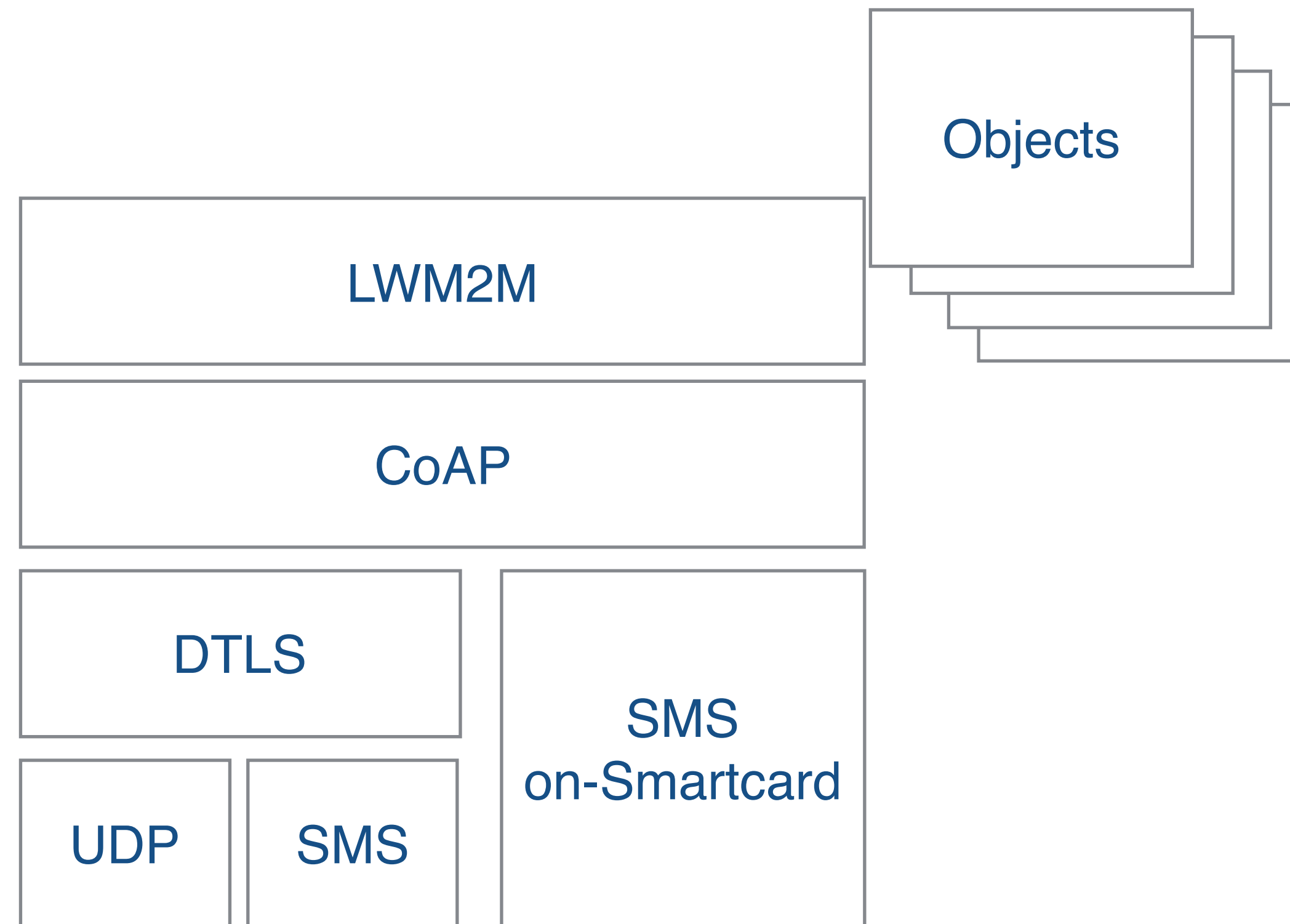
LWM2M Device Stack
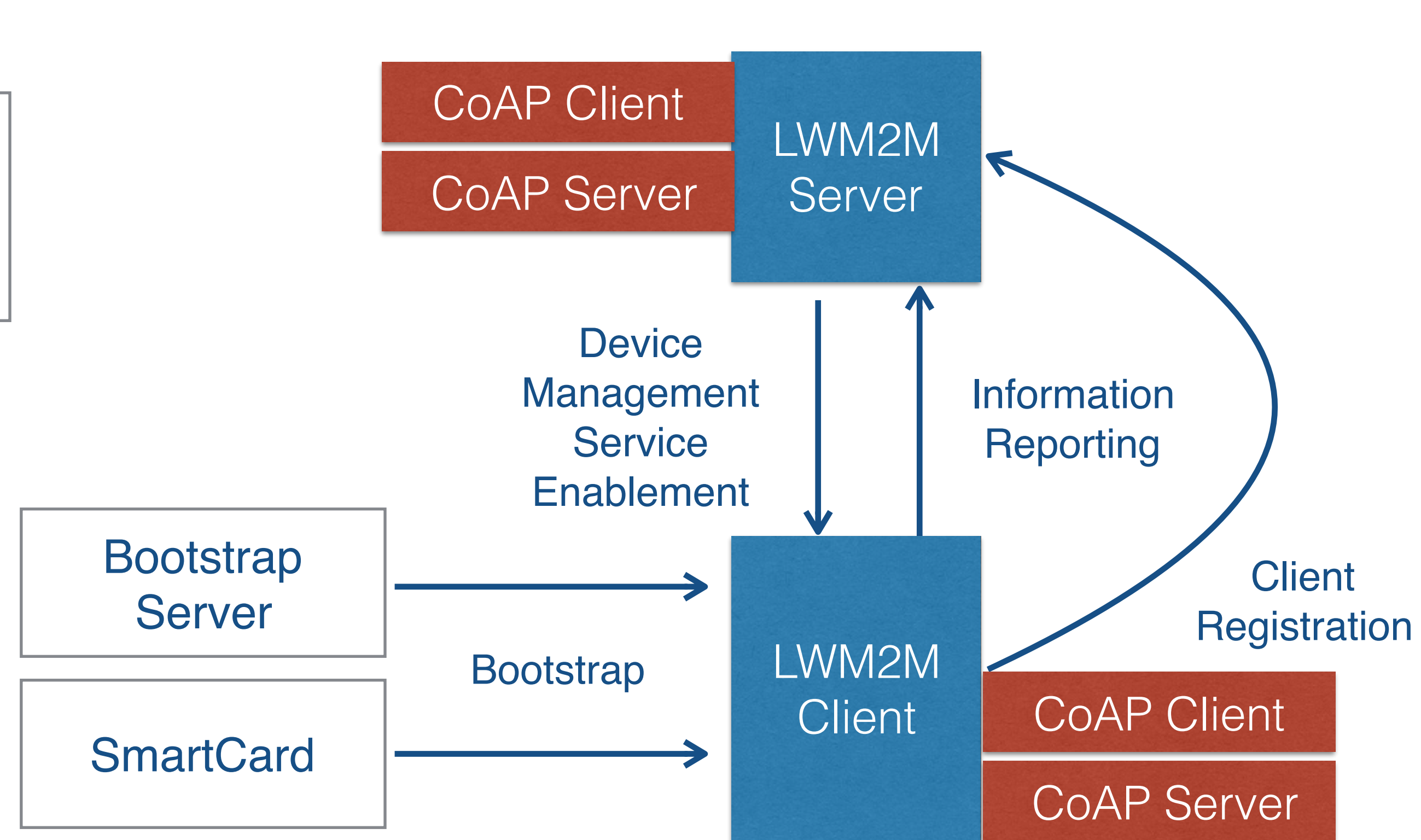
LWM2M Architecture

LWM2M Interactions

OMA LWM2M Specification

Possible LWM2M Additions

1. **Device and Manager configuration.**

   Currently covered by LWM2M.

- *[I-D.ietf-core-coap-tcp-tls]* outlines the changes required to use CoAP over TCP, TLS, and WebSockets transports.

- *[I-D.ietf-core-object-security]* For systems in which endpoints work behind a gateway or use LWM2M for managing the gateways, it might be good to implement other types of cryptographic protection than DTLS.

- *[I-D.ietf-core-etch]* Support for features like PATCH/FETCH could be greatly beneficial for things like firmware upgrade or observing relatively large sets of resources.

Possible LWM2M Additions
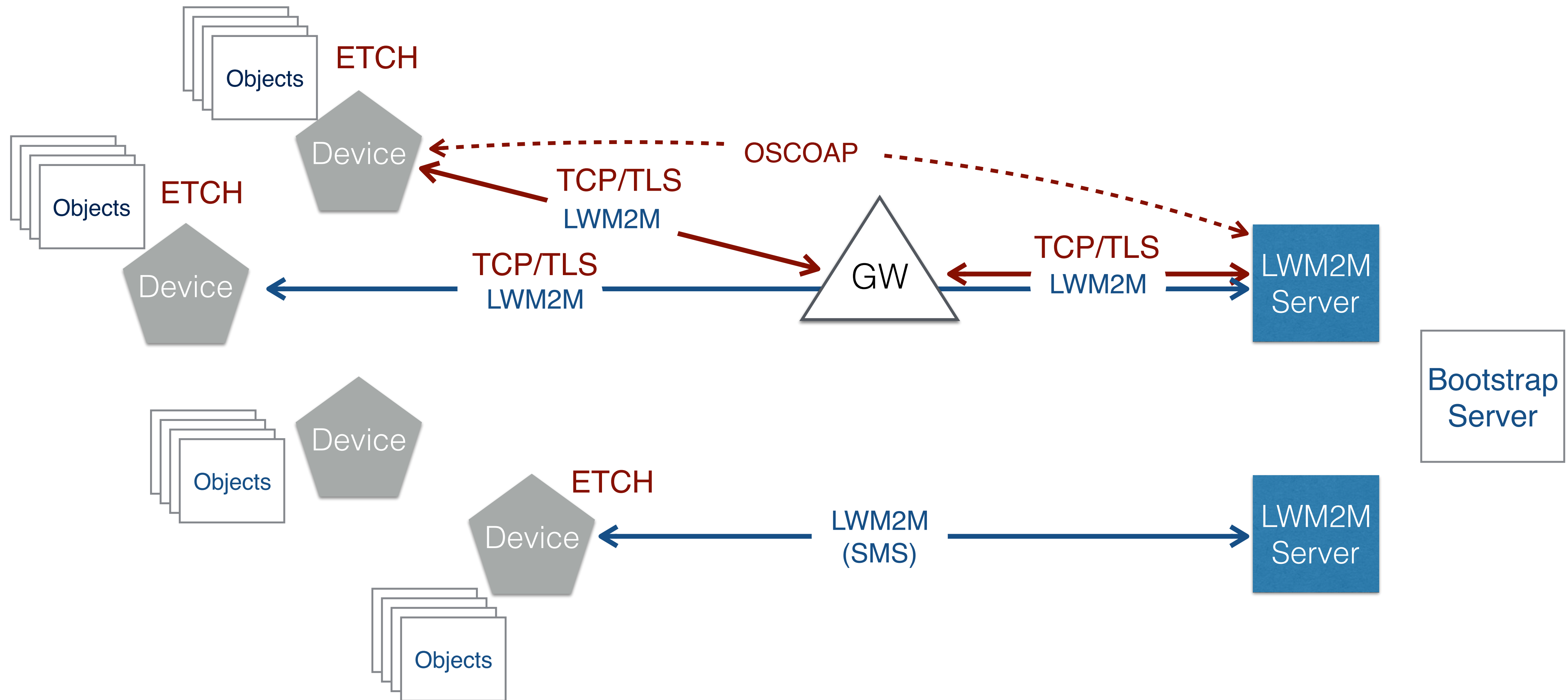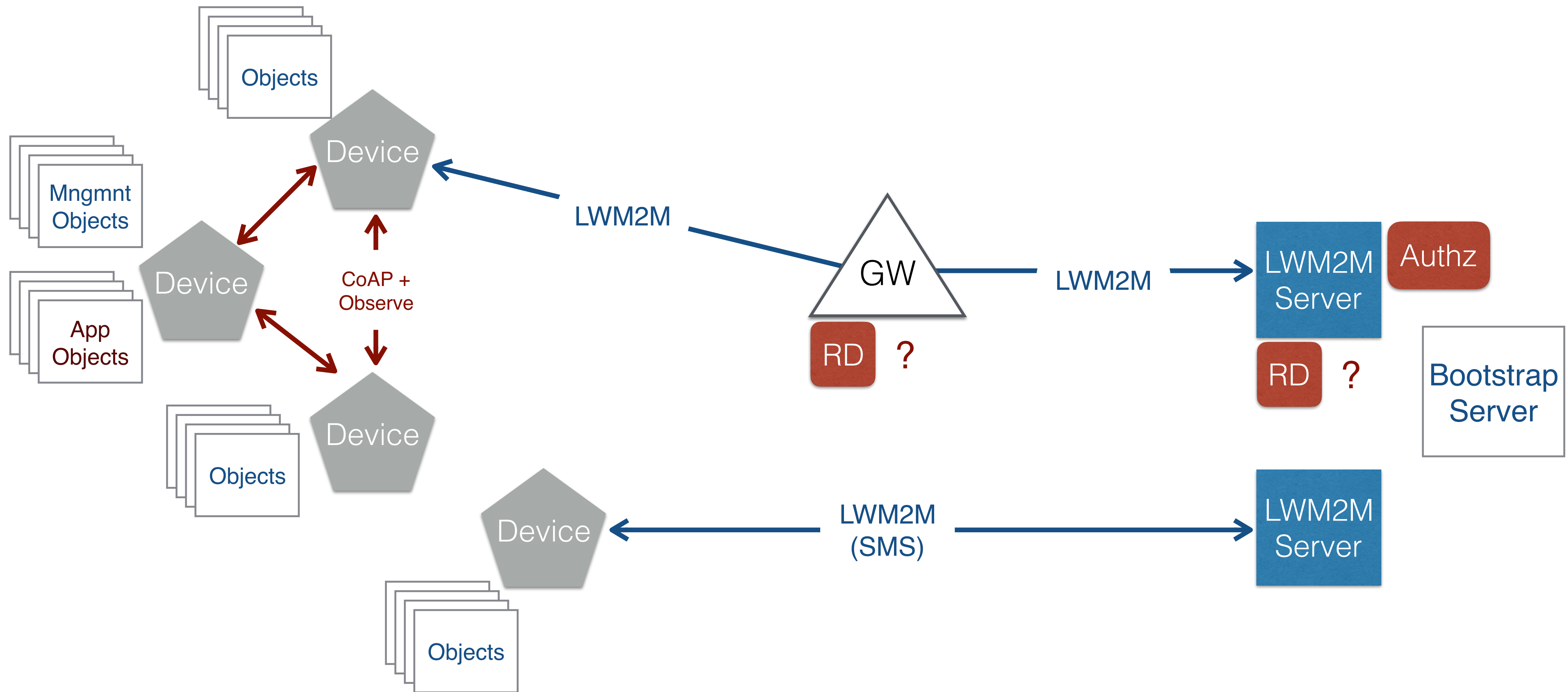
Possible LWM2M Additions

2. Device to Device configuration.

- *[I-D.ietf-core-resource-directory]* CoAP's in-built discovery would be beneficial to support cases in which devices talk to each or in which a more autonomous management approach is preferred. For now devices under the same subnet can use IP multicast as expressed on [RFC7390] and through /.well-known/core.

  Devices would support CoAP Observe [RFC7641] between each other in order to subscribe to updates from one another.

- *[I-D.ietf-ace-oauth-authz]* could be used as security framework and the LWM2M Server would act as Authorization Server.
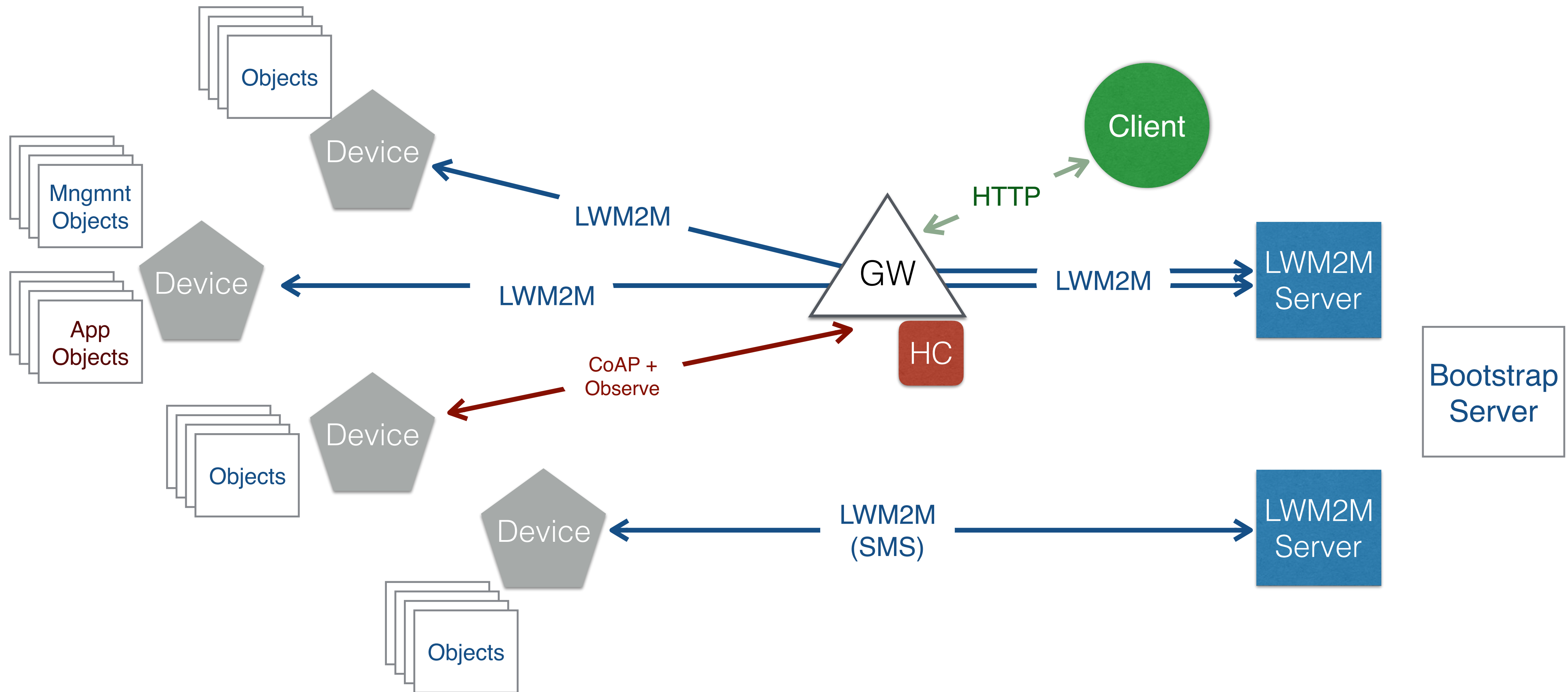
Possible LWM2M Additions

Possible LWM2M Additions

3. Device to Application configuration.

Including the aforementioned on (1) and (2).

[I-D.ietf-core-http-mapping] in cases of phone talking to GW. GW should implement a HC proxy.

Possible LWM2M Additions

LWM2M Data Model

- [RFC6690] Web Linking. ObjectLinks (String<ObjectID:InstanceID>) are not sufficient to represent links between devices or applications.

- Use unique ResourceIDs and register them to consistently use the same identifiers for the same resources.

- Update the serialization format [RFC7049]. JSON can be greatly compressed to CBOR format.

- A lot of work has happened on the Data Model space, perhaps it is time to revisit the Object Model. [IOTSI]

Assorted References

REST	https://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm
CoAP	https://tools.ietf.org/html/rfc7252
CoRE Link-Format	https://tools.ietf.org/html/rfc6690
CoAP Observe	https://tools.ietf.org/html/rfc7641
CBOR	https://tools.ietf.org/html/rfc7049
IOTSI	https://www.iab.org/activities/workshops/iotsi/
IOTSU	https://www.iab.org/activities/workshops/iotsu/
CoRE RD	https://datatracker.ietf.org/doc/draft-ietf-core-resource-directory/
LWM2M	https://github.com/OpenMobileAlliance/
CoMI	https://tools.ietf.org/wg/core/draft-ietf-core-yang-cbor/
CoAP-SNMP Interworking	https://tutcris.tut.fi/portal/files/1076133/lindholm_ventola_coap_snmp_interworking.pdf
CoAP TCP+TLS	https://tools.ietf.org/wg/core/draft-ietf-core-coap-tcp-tls/
IPSO	http://ipso-alliance.github.io/pub/
LWM2M to YANG	https://tools.ietf.org/html/draft-vanderstok-core-yang-lwm2m-00
OSCOAP	https://tools.ietf.org/wg/core/draft-ietf-core-object-security/
CoAP for LWM2M	https://tools.ietf.org/html/draft-jimenez-t2trg-coap-functionality-lwm2m